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ABSTRACT

This paper discusses the need for qualified teachers in specific areas, examining factors that motivate students to choose to teach (e.g., desire to work with people, value to society, and family influence). The Partnership for Excellence in Teacher Education promotes reform in science and mathematics teaching and learning in regard to preparing science and mathematics teachers. One of its goals is to recruit and retain promising students into teaching, particularly minority students. Researchers investigated how undergraduate content majors viewed teaching as a profession, studying undergraduate students from various mathematics and science areas who were enrolled in a summer course to expose them to the possibilities of teaching as a career. Participants read and discussed information on teaching and taught summer school students enrolled in a prefreshman engineering program. Participants kept journals and, at the end of the course, answered questions about their educational experience and their feelings about teaching. Respondents reported that the summer experience was positive. They learned that teaching was challenging but rewarding. Nearly all participants reported a strong desire to teach. They were concerned about student classroom behavior and motivation. Overall, they learned to examine and reflect upon teaching and issues of instruction. (Contains 33 references.) (SM)

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Uncle Sam Wants You: Looking for a Few Good Teachers[1]

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Mathematics and science standards, along with a shortage among qualified teachers, have brought forth increased interest in the preparation teachers receive in their fields. The teachers' educational background is the most widely accepted standard of teachers' understanding of and expertise in their field. Educational backgrounds of mathematics and science teachers are not consistent. While no one would argue the need for teachers to know their content, many middle school mathematics and science teachers fall short in meeting recommendations for coursework preparation made by national associations of teachers. The problem is particularly acute in mathematics. Only 7 percent of middle school mathematics teachers have taken courses in all recommended areas and about one-third have completed none of the coursework recommendations (NSF (b), 1998). Often state certification requirements do not maintain high expectations in mathematics and science background for teachers. One study found that most secondary students pursuing a minor in education were not required to take courses in pedagogy and that most elementary teachers did not have adequate subject matter preparation (Luft, Buss, Ebert-Mat, & Eslamieh, 1997). Frequently teachers are assigned to teach outside of their fields. Principals report that they have vacancies that they could not fill with a qualified teacher. As a result principals use substitutes, hire less qualified teachers, or cancel courses (The Education Trust, 1996). 40 per cent of high-school mathematics courses in high-poverty schools have no training in mathematics. Teacher shortages often force school districts to place teachers in mathematics and science classrooms with little or no background in these important curriculum areas. There is evidence that shows a correlation between out-of-field teaching (lack of strong formal preparation in the content area being taught) and lower student performance (ECS, 1999). It is content area preparation, then, and not certification per se, that may be a relevant consideration. It is tempting to assume that apparent improvement in the academic qualifications of candidates translates into a good crop of new teachers and to relax attention paid to intellectual traits (habits or practices) desired in good teachers. Certainly this assumption has been clearly accepted as to the abilities of university professors to produce good students. However, having knowledge of a subject and competence in teaching it are two different qualities (Cruickshank & Associates, 1996).

For the past ten years, the supply of teachers of public elementary and secondary school teachers has grown. In 1999 the number of teachers in the United States was 3.1 million, 2,666,034 of who teach in public schools. This number is predicted to increase by 1.1 percent annually to a total of 3.46 million by 2008. The projected demand for teachers may outpace the projected growth in the supply. Some researchers estimate that districts will have to hire 200,000 teachers annually over the next decade to keep pace

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with rising student enrollments (Yasin, 1999). The problem is complicated by the fact that the attrition rate for beginning teachers is rather high. Some researchers estimate that one in four new teachers will leave the profession within their first two years of teaching. Urban and poor communities will have the greatest need for teachers (Conners, 1994) and will attract the smallest group of qualified applicants.

Most students in teaching schools and colleges are white and female, yet 35% or more of their students are minorities. The United States is growing increasingly diverse. The Hispanic population grew more than seven times as fast as other parts of the country between 1980 and 1990 and is projected to double from the year 2110 to 2050, from 39.3 million to 80.7 million (U.S. Census Bureau: 1993), yet few schools reflect this population percentage in the teaching classroom. A school with adequate resources, including well-trained mathematics and science teachers, may well succeed with students whose values and experiences harmonize with those of the school. However, these same schools and teachers may be far less successful if the school is dismissive of education that is consonant with students' cultural backgrounds (Ginorio & Huston, 2001). Given the larger percentage of minority students in the public schools and the small percentage of minority teachers, a larger representation of minority teachers in the teaching force is highly desirable. The teaching and learning that takes place in a classroom is at the front line of any reform and the teachers are the DNA of successful learning.

Some areas of the country report few teacher shortages however the existence of an overall shortage in the nation is not the crux of the problem. The shortage of well-qualified teachers in the "hard-to-staff" schools is considered the core of the entire teacher supply problem and if the problem were solved for these schools, it would be solved for all schools (ECS, 1999). "Hard-to staff" schools are those with (1) large percentage of socioeconomically disadvantaged students, (2) difficult teaching environments, (3) undesirable school locations, and (4) low academic achievement of student populations. The basic problem is an insufficient supply of effective teachers (teachers who can successfully promote student learning) for all students, including high-poverty and minority students in mathematics, science and all fields. The problem is complex and multi-faceted: not only do some schools have fewer well-qualified teachers than other schools, but these schools require teachers who have greater-than-average skill if they are to be effective in the face of the many barriers often posed by socioeconomically disadvantaged students. Recruiting, preparing, and retaining good teachers is the central strategy for improving our schools (NCTA, 1996). Yet, little solid data exists to prove that various solutions or programs to address the recruitment, preparation, and retention of teachers are the most successful strategies or the most cost effective.

Approaches to Teacher Recruitment

A variety of plans have been implemented to recruit teachers throughout the United States. The "Beginning Teacher Support and Assessment (BTSA) program, Alternative Certification (ACP) programs, Para-Professional Programs, and Emergency Certification programs are a few which at first seem to attract groups of individuals to the teaching profession. In California there are presently 30,000 educators on emergency permits, which means they are not certified as educators. One-third of these leave every

year for various reasons (Gelb, 2000). Bill Hawley, of the University of Maryland, suggests the development of a through evidential matrix for various strategies that have been employed to address the various aspects of the problem of recruiting, preparing, and retaining teachers. It would note research support, expert consensus, and relative cost for different strategies. The matrix would look something like the following:

Approaches to Teacher Recruitment

RESEARCH SUPPORT	STRATEGIC GOAL			
	Increase Candidate Pool *Cost**	**Improve Teacher Preparation** *Cost**	**Increase Teacher Skill and Commitment** *Cost**	**Retain Teachers** *Cost**
Satisfactory Evidence of Positive Results and Widespread Expert Consensus	Pre-collegiate Recruitment *Low* Internship for mid-career professionals *High*	Test verbal ability/ content knowledge *Low* Insure solid grasp of subject matter and pedagogy *Medium* Professional development schools *Medium*	Comprehensive induction program *Medium* Eliminate emergency licensure *Medium* Eliminate out-of-field teaching *Medium*	Comprehensive induction program *Medium*
Inadequate Evidence but Expert Consensus	Improve recruiting process Low Equalize teacher salaries *High* Incentive pay to teach in hard-to-staff schools *High* Targeted loan forgiveness *Medium to High*	Improve teacher candidate ability to teach diverse and special needs students *Low to Medium* Performance based to certification *Low to Medium*	Attract high-quality, exper=erienced teachers to hard-to-staff schools *High* Increase begininnig teacher salaries High Performance based licensure *Low to Medium*	
Inadequate Evidence and Little Consensus	Recruitment Incentives *Medium* Incentive pay for hard-to-staff subjects *High*	Extended fifth year programs *High* Minimize alternative certification and licensure *Medium* Deregulate licensure *Low* Raise cut-off scores on entrance tests *Low*	Allocate salary increases after initial years *High*	Allocate salary increases after initial years *High*

Cost estimates are debatable. Low cost= less than $500/student or teacher candidate with no continuing cost. Medium cost= $1500-2500. High cost= over $2500, continuing each year. Medium-to-high cost= high cost but not continuing over tiem.

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One of the serious impediments to the discussion of teacher supply is the lack of good information, and the lack of comparable information, collected by the states (ECS, 1999). States need to collect comparable information with common indicators, definitions, data collection methods and a common reporting framework. Further research into what attracts qualified people needs to be implemented. What attracts people to teaching and could people with strong content knowledge be attracted to teaching? How do content people perceive the teaching profession?

Motivational Factors in Selecting Teaching as a Career

People choose teaching for many reasons. Some teachers will relate stories of playing teacher as children and always having the desire to teach. Others recall an admired teacher or adult who influenced their lives. Others believe that teaching is a societal obligation or a profession that allows free time for additional pursuits. Many preservice teachers will say the "love children" and that is why they gave decided to join the profession. Several major studies over the last thee decades have produced consistent results about the reasons individuals give for choosing teaching as a career. The American Association of Colleges for Teacher Education (AACTE) conducted yearly studies about teacher education over a nine-year period. They surveyed thousands of teacher education students in the United States Students were asked why they decided to go into teaching. The National Education Association also asks its members why they chose teaching. The following list represents a composite published in Exploring Teaching (2001) from the AACTE and NEA studies.

Reasons Given for Choosing Teaching as a Career

Reason	Range in %
• **Desire to work with people**	**65-75**
• **Value to society**	**35-40**
• **Interest in subject matter**	**35-45**
• **Family influence**	**20-25**
• **Long summer vacation**	**15-25**
• **Job security**	**15-20**
• **Self- growth & actualization**	**10-20**

While the variety of motives for teaching are interesting there is an obvious lack of consideration of teaching as a profession or an area that could advance research in learning. The motives are almost all social based rather than professional applications of training and center on the interests of the individual. Is this "loving of children" enough to prepare tomorrow's students for a digital, highly competitive society? How could we recruit qualified minority teachers with strong content backgrounds?

One factor that may influence the choice for and/or against the teaching profession is the culture differences between colleges. Duggan-Haas compares the Colleges of Education and Science in a study done in 1998. The cultures are portrayed through a series of three contrasts: (1) " Weeding Out" vs. nurturing (2) meritocratic vs. democratic and (3) masculine vs. feminine.

College of Science	College of Education
Limited Faculty Support Lectures Competitive Selection Techniques (weeding out)	Nurturing Group Work Success for All Collaborative Foster Communities

The differences may carry over to the professional appeal of careers itself with the science majors reflecting the nature of their college.

Partnership for Excellence in Teacher Education (PETE)

Partnership for Excellence in Teacher Education (PETE) is a NSF funded project to promote reform in the teaching and learning of mathematics and science in regards to the preparation of teachers who will teach mathematics and science. One of the four main goals of the PETE program is to recruit and retain promising students into the teaching profession, with particular attention to students from under-represented groups. PETE has given financial support for students entering the fields of mathematics or science teaching, provided a variety of professional development opportunities, and paired undergraduate students with in-the-field teachers. A primary challenge facing teacher educators is creating learning environments in which students learn to teach mathematics and science, but also learn mathematics and science more deeply while learning about the place of these subjects in the school curriculum and in the classroom (Comiti & Ball, 1996). The PETE research team decided to explore this issue further through an investigation into how undergraduate content majors viewed teaching as a profession.

Content undergraduate majors from geology, mathematics, biology, engineering and computer science were enrolled in a summer seminar course to expose them to the possibilities of teaching as a career. A physicist, a biologist, and a science educator team-taught the seminar each bringing in readings concerning teaching. The course was open discussion and small group assignments were given the undergraduate students. The university students met with the cross-disciplinary faculty for three hours a week and then spent 19 hours a week teaching middle and high school students enrolled in the summer prefreshman engineering program (TexPREP) under the guidance of more

experienced instructors. The participants kept a journal throughout the experience and reflected upon completion how their attitudes had or had not changed concerning the career of teaching.

At the end of the seminar the students responded to six open-ended requests:

- Briefly describe the teaching experience you had during the seminar.
- Would you consider teaching as a profession after these experiences? Why or why not?
- How do you really know if a student has really learned what you were teaching?
- What problems do you see concerning the teaching profession?
- How could the teaching profession recruit more content people (like yourselves) into the field?

Results

Two ways of understanding teaching informs the comments of the teacher recruits: teaching as a cultural activity and/or teaching as a profession. In describing teaching as a cultural activity, an everyday event, Stigler and Hiebert write.

> Cultural ativities are represented in cultural scripts, generalized knowledge about an event that resides in the heads of participants. These scripts guide behavior and also tell participants what to expect. Within a culture, these scripts are widely shared, and therefore they are hard to see (p 85).

This is not to say that there is only one script for each everyday event. Cultural activities can have many scripts, although there could be scripts that are more dominant than others. In describing teaching, they write, "the scripts for teaching .... Appear to rest on a relatiavely small and tacit set of core beliefs about the nature of the subject, about how students learn, and about the role that a teacher should play in the classroom" (p. 87). When describing teaching as a profession, Yinger writes that the work tasks of professions are characterized by professional jurisdiction (claims of control and authority for dealing with particular kinds of problems), knowledge jurisdiction (claims of control over abstract knowledge), social jurisdiction (recognition of exclusive rights of practice and to the rights of a discipline). Teaching, when understood from this perspective is defined by its authority over particular kinds of problems, its claims to knowledge of teaching and learning, and its exclusive rights for practice.

Both these lines of thought inform the comments of the recruits. When asked to describe their teaching experience, the recruits generally reported how positive the experience was, what they learned about teaching and classroom management, and the complexity of teaching. Students came away from their experience learning that teaching is challenging but rewarding. Students draw on their knowledge of teaching as a cultural activity when implying that teaching is easy and call on their knowledge of teaching as a profession when realize that teaching represents a body of knowledge and practice legitimately "owned" by teachers. As one student wrote,

> "Through the teaching experiences I saw how difficult it could be. You have to be able to control the students without intimidating or upsetting the students. You also have to really know what you are teaching and be ready to answer questions. And you also have to make the class fun and interesting."

Tie comment was typical of responses to the item, "Briefly describe the teaching experiences you have had during this semester. Recruits often mentioned the behavior of students and the need to control them. As one student put it, "... I know now that when you are first put into a classroom, you have to set the rules. This way the students know who is in control."

Responses to the item, "Would you consider teaching as a profession after these experiences? Why or why not?" revealed a strong desire of students to consider or go into teaching. Only one of the eight students reported that he/she would not. As one student wrote,

> Yes, I will be a teacher. The reasons why are so numerous that I would not do them justice. To over simplify them, I guess you could say that anyone who has an interest in the future of this world should teach because it is by the children that the future is determined."

When asked "what determines a good teacher?" teacher recruits provided descriptions of what a "teacher should do" and what characteristics a teacher should have. Students mention that a teacher should be patient and be able to motivate students. The teacher should also be able to facilitate a student's learning and who can make learning fun. Caring, commitment to teaching and to students, and being fair are important characteristics of a teacher. Knowledge of the subject is mentioned less frequently. One student summed it up this way, "Patience, knowledge of the material, and great oratory skills to keep the student interested."

Students were clear when they listed the ways by which they knew students had "really" learned the material. "Students would give the right answers." "Students asked thoughtful questions" and "when students go beyond simply repeating what has been said." Responses to this item reveal that teaching is about learning procedures, saying the correct answers, practicing problem sets, and exploring mathematical ideas. In this regard, students' answers reflect the growing discussion over what is good teaching: practice of problem sets and/or examining and exploring the important concepts that define a discipline.

When asked what problems they see concerning the teaching profession, student responses can be understood as addressing three issues: blame/control of educational outcomes and processes, instructional strategies, and students. Recruits recognize that teachers get blamed for "problems outside the control of the teacher," such as lack of resources. When describing instructional strategies students question the role of lecture only and memorization and the role of hands-on intellectually challenging activities.

Recruits are also concerned by the behavior and motivation of students. For the recruits problems of classroom behavior and lack of motivation and responsibility to learn are troubling. Comments reveal these troubling issues.

> The problems I see are mainly that early education is about memorization and familiarity (recognition and recall) ... concept-based learning is left for upper levels of math and science. We should use more concept-based learning and show the students why we memorize.

> Discipline, when students are allowed to socialize they take it to the extreme. Some students can care less about the course and distract others as well.

> One thing that I am really worried about is the way kids behave today. There is too much violence, parents don't care and don't have time for their children. Students are too lazy, they want easy things, and they are disrespectful.

Responses to the question, "How could the teaching profession recruit more content people like yourself into the field?" range from "you can't recruit because a person has to like teaching" to "maybe having a teaching class as a requirement in colleges." Students mention the nature of the field as sometimes an obstacle. For example, one students mention that to get more recruits, you need to raise requirements. For this student making teaching MORE exclusive would help. For another student, government incentives, like no taxes for life, could be a driving force in recruiting a large cadre of people interested in teaching. A majority of the students focused on making teaching experiences available. As one student wrote, " I think programs in which students can experience the things teachers go through everyday can give them an idea of what to expect and be able to become more comfortable with teaching."

Overall, students learned about teaching and learned to examine and reflect upon teaching and issues of instruction. Of particular concern for these recruits is the lack of motivation and interest by students in the public schools.

Conclusion

The undergraduate students provided new insight into teaching and learning through the lens of content majors. Three of the ten have added education as their minor and still occasionally correspond with the professors of the seminar. In summary, both mentor teachers and potential recruits agreed that the recruits had good command of content knowledge, could communicate that knowledge, and were respected by the students in the summer science and mathematics enrichment experience. Student learning was very rarely mentioned. This points to a "cultural" assumption that if one has good command of content knowledge, can communicate that knowledge to students, and are respected by students then students are learning. Clearly, as teaching moves to

incorporate teaching standards and content standards into the ways of discussing and reflecting upon teaching, descriptions of teaching will become more infused with descriptions of student outcomes. On items that asked if the recruit had a positive attitude toward teaching or indicated potential successful teaching, the mentors rated the recruits as having "very strong" positive attitudes and potential. No recruits were rated low on these items. When describing their overall ratings of the teacher recruits, there was agreement that the recruits did an excellent job teaching and working with the students in the summer program. They mentioned that teacher recruits motivated the students, were good role models, and came prepared to teach and work with the students. All in all, the mentor teachers reported that the teacher recruits have very strong potential for becoming very good teachers.

When asked to reflect on their experiences, recruits mentioned the challenges they faced when designing and conducting a lesson: lecturing versus hands-on activities, making the lesson intellectually challenging and making the lesson fun, trying to find ways to connect with the students, and applying classroom management. They generally agreed that teaching was a much more challenging profession than they had originally thought. They left the summer teaching seminar experience with greater respect for teachers, good teaching and teachers' commitment.

Most importantly, recruits' comments revealed the ambivalence the public has concerning teaching and teaching as a profession. On the one hand, recruits made sense of teaching in terms of an understanding that teaching is a cultural activity -- something that is taken for granted, an "activity" everyone has experienced because everyone was a student, therefore everyone is an expert on "good teaching." Students mentioned that they came to the seminar believing that teaching is easy. On the other hand, recruits called on an understanding that teaching is a profession that holds special authority and is defined by specialized knowledge and skills. As one student commented, "

> My teaching experiences were positive and insightful. They taught me that teaching is not a job. Meaning that it is not something that you do from 7:30 – 4:00 or what have you. Teaching is an investment of everything you have. My teaching experience has shown me that in every exposure to the class you teach more than just the subject material you are presenting, but also every aspect of yourself is observed and judged by your students. Teaching makes me want to excel at whatever I am doing.

As the debates and move for accountability increases this ambivalence will continue to inform the decision-makers, the public, teachers and potential teachers as to the nature of teaching. Is teaching a profession with authority and specialized knowledge and skills or is it a "cultural activity" one in which experience as a student makes someone an expert in teaching?

Most of the students ended the summer experience seriously considering teaching as an option. As one student wrote when asked if he/she would consider teaching as a profession

Yes, I just changed to math with secondary certification and before this program, I told myself, "I'll decide after this semester if I change my mind." This really helped me and pushed me to decide for teaching."

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